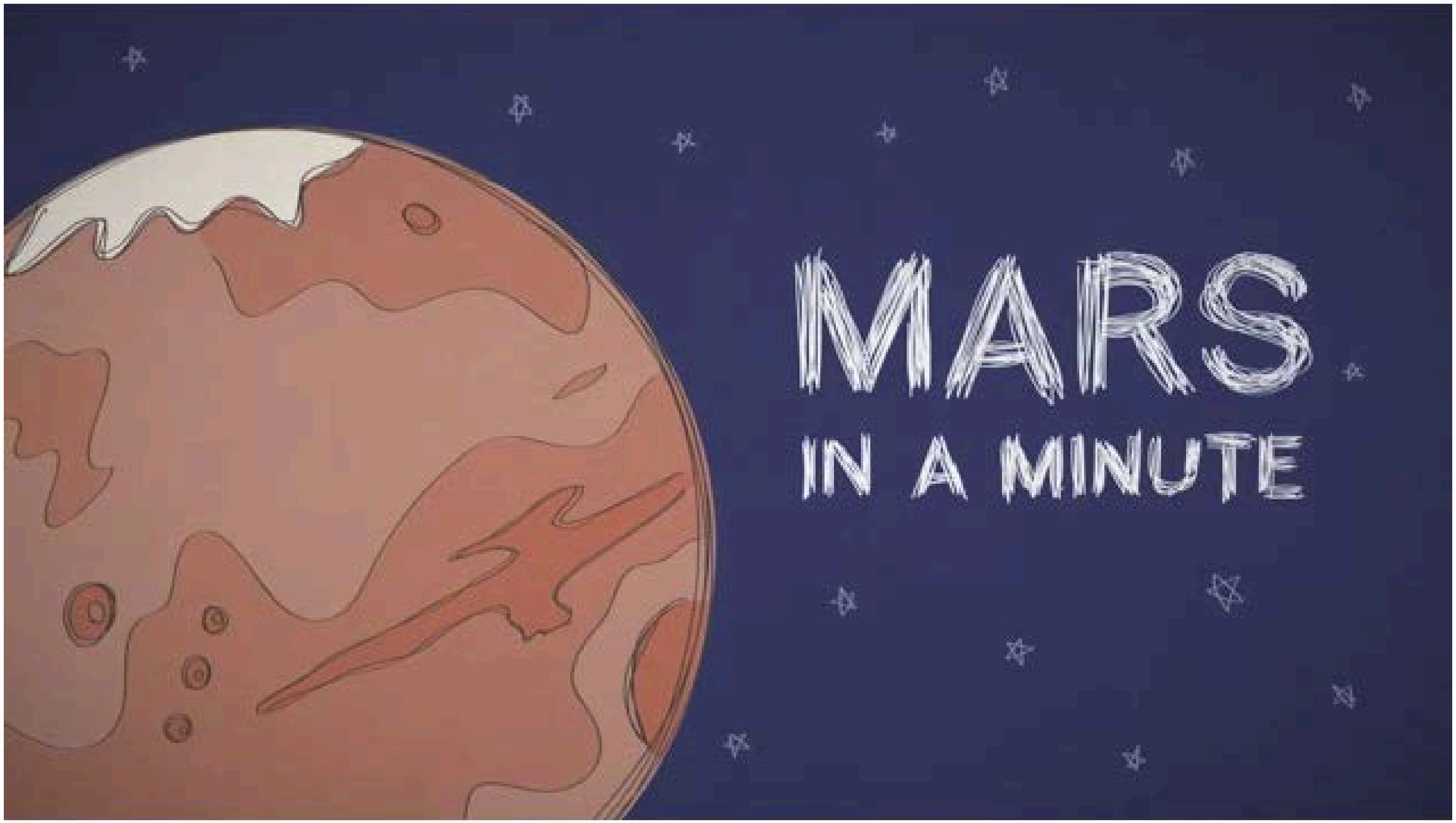
NASA STEM CHALLENGE

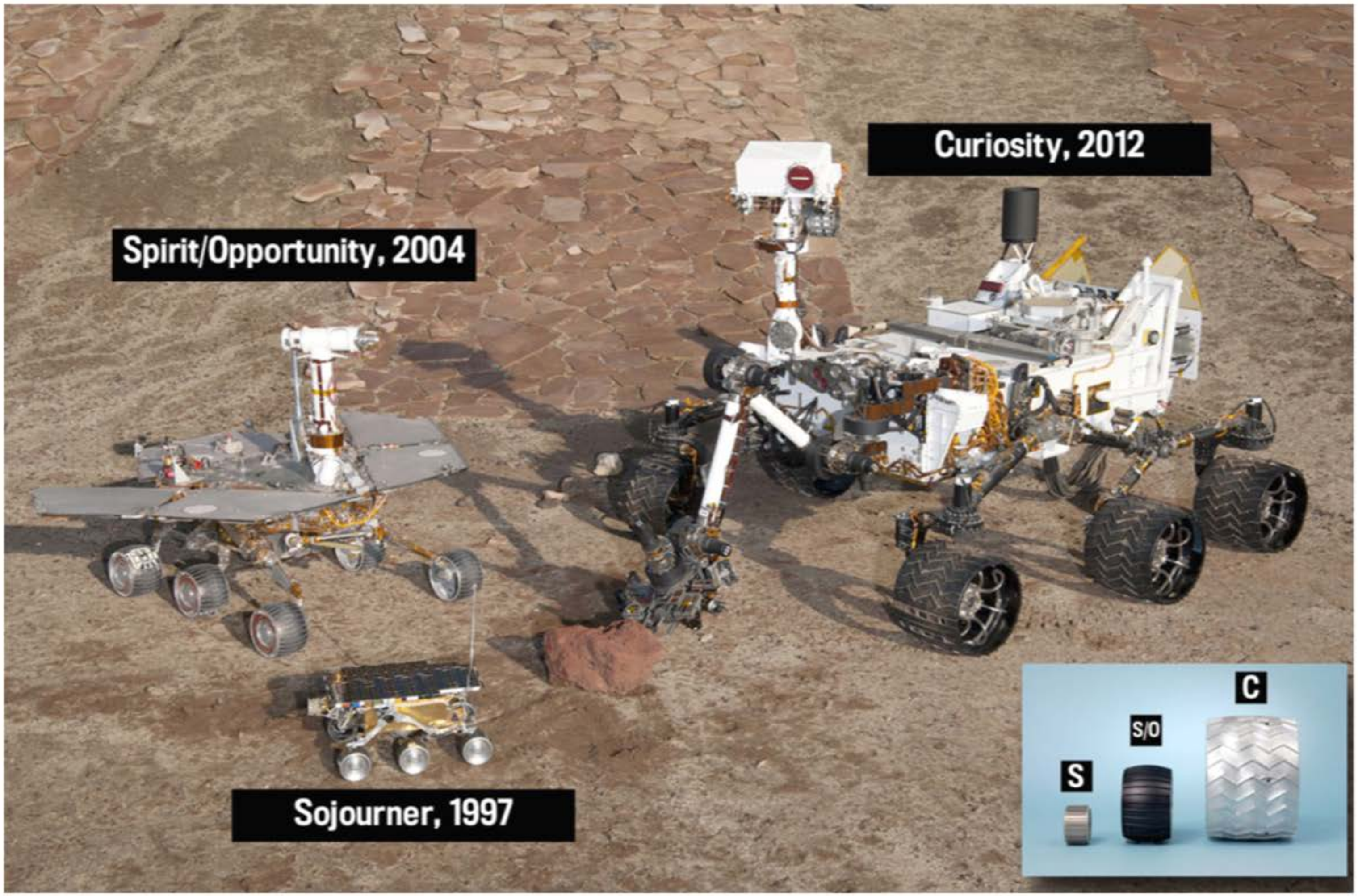
Amazing Supersonic Decelerator: Parachuting Onto Mars!

How Do We Land on Mars?

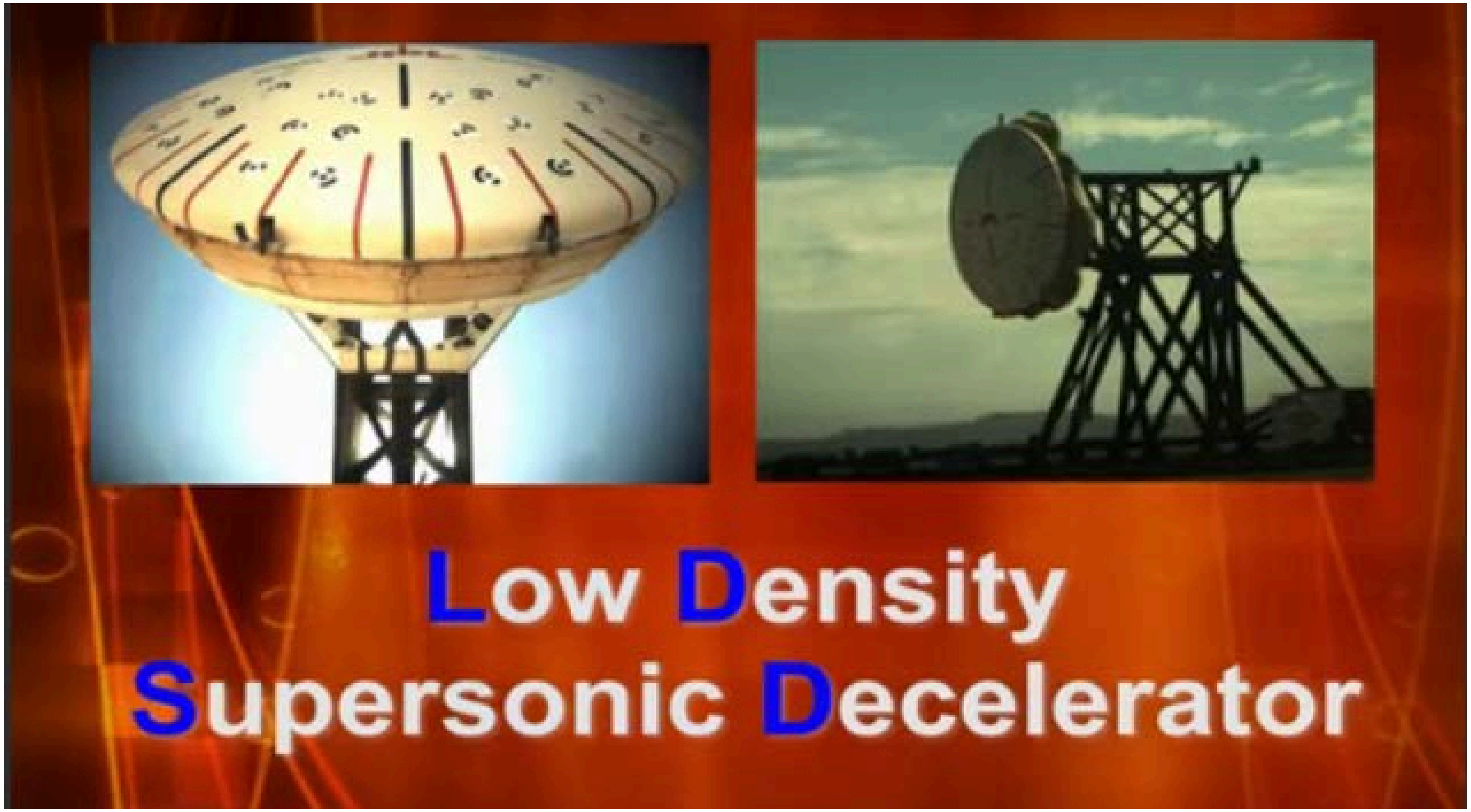


Watch or download this video here:
http://www.jpl.nasa.gov/education/videos/playVideo.cfm?videoID=30

Mars Rover Family Portrait



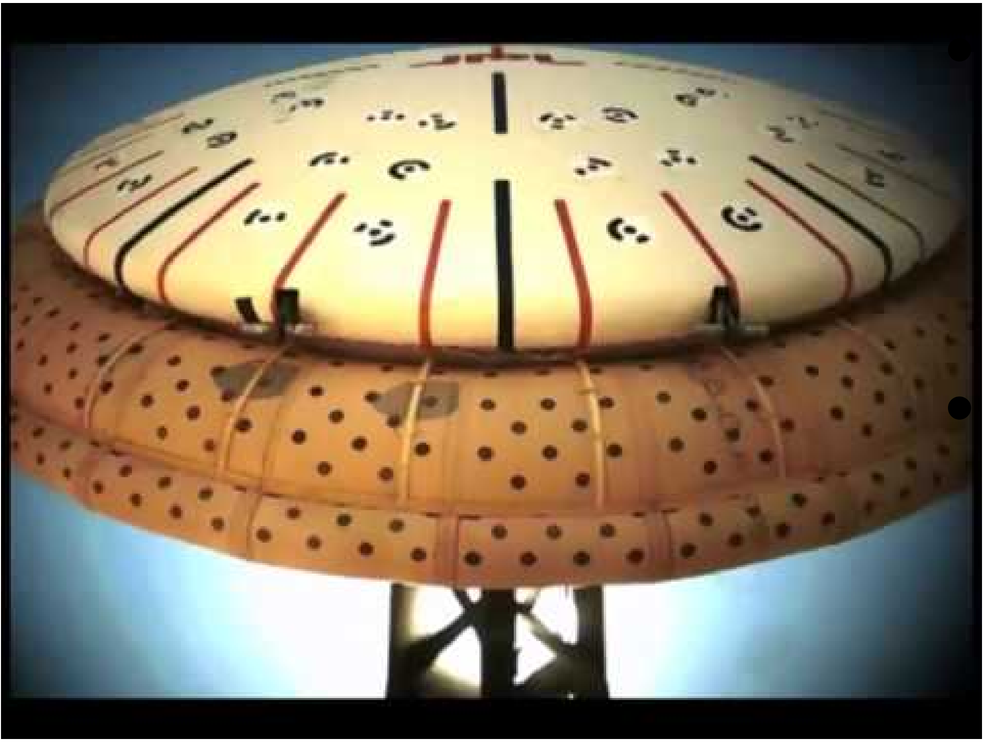
NASA Is Working on this RIGHT NOW!



Watch this video here:
http://www.youtube.com/watch?v=RmhSb34PlZQ&list=PLiuUQ9asub3QWTlo2mvYo7b3E1l18MgDP&index=13

Low Density Supersonic Decelerator Super Parachute

- We need bigger and better parachutes to carry larger equipment, robots, rovers to Mars.



- Testing three different designs
  - 6 meter, 8 meter, and 30 meter diameter
- All three are the LARGEST of their kind ever flown at these speeds!

Slowing things down

- *In what ways can we slow things down?*
- *How can we slow down a spacecraft??*
- *What geometric shapes might work?*

Your Challenge from NASA!

THE CHALLENGE

Design a drag device to protect the weighted cargo bay when it is dropped from a specified height (at least 2 meters). Data gathered in this challenge includes surface area, mass, and descent time. Redesign to improve your drag device drop performance.

The design constraints are:

- Use only materials provided to you to create the drag device.
- The overall mass of your drag device cannot exceed 50 grams.
- Drag devices must have at least five separate angled edges (rounded edges are allowed, but one big circle is not allowed).
- Test drops must be from at least 2 meters.
- Must use the template provided for you to build a cargo bay for your egg capsule.

REMINDER!

- Be sure to document all design and test results.
- Make any necessary design changes to improve your results and retest. Document the modifications and results.
- Complete all conclusion questions.

ENGINEERING DESIGN PROCESS

Ask

What questions do you have about today's challenge?

Imagine

What shape will you use for your drag device?

Will you include any special features?

Everyone will use the same spacecraft template.

Plan

1. Draw your design on paper, including measurements.

2. Calculate mass and surface area of your drag device.

3. Instructor must approve drawing before building begins.

Create

Begin building!

Be respectful of supplies.

Experiment

Experiment & Record

1. Record the mass and calculate the surface area in the table below. Use the space below to show calculations.

2. Record the drop height: ____

Review Experiment Rules

- Drop Procedure
- Safety

Experiment

	Mass (g)	Surface Area (cm^2)		Time (sec)	Speed (cm/sec)	Note any damage after each drop
Design 1			Drop #1			
			Drop #2			
			Drop #3			
			Average			
Design 2			Drop #1			
			Drop #2			
			Drop #3			
			Average			

Experiment

Experiment & Record

4. Plot results on a scatter graph. The surface area (the independent variable) is plotted on the X axis, and the time it takes for the egg to drop (the dependent variable) is plotted on the Y axis. For students calculating speed, plot the speed of descent on the Y axis. Label graph appropriately.

Improve

- Think about your design.
- Make improvements to try to increase the amount of time it takes for the spacecraft to drop (increasing drag).
- Test again.
- Plot results on the same graph, in a different color.

Team Review

For the Student

Quality Assurance Form

Each team is to review another team's design and model, then answer the following questions.

NAME OF TEAM REVIEWED: ____________________

	Yes	No	Comments
Was the drag device securely attached to the cargo capsule?			
Was the mass of the entire drag device below 50 grams?			
Did the team correctly collect, calculate and record data?			
Did the team have a successful drag device? (No broken materials.)			

Team Review, continued

LIST THE SPECIFIC STRENGTHS OF THE DESIGN:

LIST SPECIFIC WEAKNESSES OF THE DESIGN:

HOW WOULD YOU IMPROVE THE DESIGN?

Inspected by: ______________________________

Signatures ______________________________

____

____

Sharing Discoveries

1. Review data from all teams.
2. Which drag device design characteristics provided the most reliable results and why?
3. Which design had the slowest descent (longest drop time)?
4. What was learned about the relationship between surface area and drop time (or speed)?
5. What information could engineers working on this project learn from your team's results?
6. What other testing and calculations could you do before making your recommendations to the engineering team?